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FINAL TECHNICAL REPORT

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"Theoretical Study of Kinetic Processes on Solid Surfaces and Interfaces"

Principal Investigator: Prof. See-Chen Ying  
Physics Dept., Brown University, Providence, RI 02912.

91-16064

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by NSA/CSS

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### Publications in Referred Journals

1. "Effective Two-Dimensional Lattice Dynamical Hamiltonian for Surface Structural Phase Transition" (with G. Y. Hu), J. Vac. Sci. Tech. A2, 1009 (1984).
2. "Model for the Surface Reconstruction Phase Transition of Clean and Hydrogen Adsorbed W(001) Surface and Approximate Solution" (with L. D. Roelofs and G. Y. Hu), J. Vac. Sci. Tech. A2, (1984).
3. "Effective Potential for Kinetic Processes on Semiconductor Surfaces" (with T. L. Reinecke), J. Vac. Sci. Tech. B2, 573 (1984).
4. "Model for Surface Reconstruction Phase Transition for Clean and Hydrogen Adsorbed W(001) Surface: Low Coverage Solution" (with L. D. Roelofs), Surf. Sci. 147, 203 (1984).
5. "Structural Phase Transitions on W and Mo Surfaces" in Dynamical Phenomena in Surfaces, Interfaces, and Superlattices, Springer-Verlag series in Surface Science 3, eds. F. Nizzoli, K. H. Rieder and R. F. Willis (1985).
6. "Theory of Commensurate-Incommensurate Transition on W(001)" in Structure of Surfaces, Springer-Verlag series in Surface Science 2, eds., M. A. Van Howe and S. Y. Tong.
7. "Effective Two-Dimensional Lattice Hamiltonian for Surface Structural Phase Transition" (with G. Y. Hu), Surf. Sci. 150, 47 (1985).
8. "Resistivity of a 2-D Electron Gas Under Strong Magnetic Field Using Memory Function Formulation" (with I. C. da Cunha Lima), J. Phys. C18, 2887 (1985).
9. "Soft Phonon of Ni(100) Surface," Proc. of 4th Int. Conf. on Vibrational Properties of Surfaces, eds. King, Richardson, and Holloway (Elsevier, 1986).
10. "Vibrational Properties of the  $\sqrt{2} \times \sqrt{2}$  R45° W(100) Surface" (with T. L. Reinecke), Proc. of 4th Int. Conf. on Vibrational Properties of Surfaces, eds. King, Richardson, and Holloway, (Elsevier, 1986).
11. "The Vibrational Properties of the Si(100)  $2 \times 1$  Surface" (with S. Tiersten and T. L. Reinecke), Phys. Rev. B33, 4062 (1986).
12. "Reconstruction of the W(100) Surface Induced by Hydrogen Adsorption" (with J. W. Chung and P. J. Estrup), Phys. Rev. Lett. 56, 749 (1986).
13. "Adsorbate-Induced Reconstruction of Ni(100) Surface" Phys. Rev. Lett. 56, 536 (1986).
14. "Effect of Adsorbate Binding Sites on Surface Reconstruction Phase Diagram: O/W(001) and H/W(001)" (with L. Roelofs, P. Estrup, and J. W. Chung), Phys. Rev. B33, 6537 (1986).

15. "Vibrational Correlation Function for Si and Ge" (with A. Steif and S. Tiersten), *Phys. Rev. B* **35**, 857 (1987).
16. "Vibrational Properties of the Reconstructed W(100) Surface" (with T. L. Reinecke), *Phys. Rev. Lett.* **58**, 242 (1987).
17. "Monte-Carlo and Coarse Graining Renormalization Studies for the X-Y Model with Cubic Anisotropy" (with G. Y. Hu), *Physica* **140A**, 585 (1987).
18. "Reconstructive Phase Transitions and Effective Adsorbate-Adsorbate Interactions: H/Mo(100) and H/W(100)" (with J. Prybyla, P. J. Estrup, Y. Chabal, and S. B. Christman), *Phys. Rev. Lett.* **58**, 1877 (1987).
19. "Phase Transformations of the H/W(110) and H/Mo(110) Surfaces," (with M. Altman, J. W. Chung, P. J. Estrup, J. M. Kosterlitz, J. Prybyla and D. Sahu), *J. Vac. Sci. Tech. A* **5**(4), 1045 (1987).
20. "Theory of Phase Transitions in the H/W(110) and H/Mo(110) Systems," (with D. Sahu and J. M. Kosterlitz), "Structure of Surfaces II" eds. J. F. Van Der Veen and M. A. Van Hove (Springer-Verlag) (1988).
21. "Indirect Phonon Mediated Adatom-Adatom Interaction," (with S. Tiersten and T. L. Reinecke), *Proc. of 5th Int. Conf. on Vibration at Surfaces* (Germany, 1987).
22. "Equilibrium Stability of Strained Epitaxial Layers on a Rigid Substrate," (with E. Granato and J. M. Kosterlitz), *Proc. of Latin American Conference on Semiconductor Physics* (San Carlos, Brazil, 1987).
23. "Equilibrium Theory of Strained Epitaxial Layers," (with E. Granato and J. M. Kosterlitz) *Phys. Rev. B* **39**, 3185 (1989).
24. "Melting of a Free Bilayer," (with E. Granato and J. M. Kosterlitz), *Phys. Rev. B* **39**, 4444 (1989).
25. "Phase Diagram of CO/Rh(111) at Low Coverages," (with J. Kjoll and T. Ala-Nissila), *Surf. Sci.* **214**, 448 (1989).
26. "Adatom-Adatom Interaction on Solid Surfaces," (with S. Tiersten and T. Reinecke), *Phys. Rev. B* **39**, 12575 (1989).
27. "Diffusion Anisotropy of Oxygen and Hydrogen Adatoms on W(110)," (with J. Kjoll and T. Ala-Nissila), *Surf. Sci. Lett.* **218**, L476 (1989).
28. "Structural Phase Transition on W(100)," (with W. K. Han) *Phys. Rev. B* **41**, 9163 (1990).

29. "Diffusion of Particles in Inhomogeneous Medium: High Friction Limit, Phys. Rev. B41, 7068 (1990).
30. "Universal Properties of Classical Surface Diffusion," (with T. Ala-Nissila), Phys. Rev. Lett. 65, 879 (1990).

Statement A per telecon  
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Arlington, VA 22217-5000  
NWW 12/12/91

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Ph.D. students directed under this contract

G. Y. Hu, (Ph.D. 1985)  
S. Tiersten, (Ph.D. 1986)  
W. K. Han, (Ph.D. 1991)  
J. Kjoll, (Ph.D. expected in 1992)

Other Personnel:

T. Ala-Nissila (Research Associate, Jan. 88-Dec. 90)  
D. Sahu, (Research Associate, Sept. 85-Sept. 87)  
Ivan Costa da Cunha Lima (Visiting Research Associate, 88-90)  
Amos Troper, (Visiting Research Associate, 88-90)  
K. Kankaala, (Visiting Research Assistant, 87-90)

Invited Presentation at Conferences

- (1.) Lecturer at the Summer School on "Dynamical Phenomena at Surfaces, Interfaces and Superlattice" in Erice, Sicily, July 1984.
- (2.) Invited speaker at the second Ringberg International Workshop on Surface Phonons in Kreuth, Germany, June 1987.
- (3.) Invited participant in the international workshop on "Nonlinear Charge Density Wave Systems", June 1987 Trieste, Italy.
- (4.) Invited speaker at the third Ringberg International Workshop on Surface Phonons in Kreuth, Germany, June 1990.